

*ESCAPE AS A FACTOR IN THE AGGRESSIVE  
BEHAVIOR OF TWO RETARDED CHILDREN*

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This study sought to identify some of the variables controlling the severely aggressive behavior of two retarded children. In Experiment 1, each child was presented with several demand and nondemand situations. Aggression was frequent in the demand situations and rare in the nondemand situations. When a stimulus correlated with the termination of demands was introduced, aggression fell to a near zero level. In Experiment 2, for one child, a variety of preferred reinforcers was introduced into the demand situation contingent on correct responding. Aggression abruptly decreased to a low level. Experiments 3 and 4 involved the second child. In Experiment 3, this child was permitted, in one condition, to leave the demand situation if he emitted a nonaggressive response. Aggression decreased to a low level. In Experiment 4, he was prevented, in one condition, from leaving the demand situation in spite of high levels of aggression. Aggression fell to a near zero level. In Experiments 3 and 4, he was permitted, in several conditions, to leave the demand situation following aggressive behavior. Aggression increased to a high level. The results suggested that: (1) aggression can sometimes function as an escape response; and (2) escape-motivated aggression can be controlled by: (a) introducing strongly preferred reinforcers to attenuate the aversiveness of the demand situation; (b) strengthening an alternative, nonaggressive escape response; or (c) using an escape-extinction procedure.

DESCRIPTORS: aggressive behavior, escape, reinforcement, extinction, retarded children

No human behavior arouses more social concern than that of aggression. At the level of the individual child, high-frequency aggressive behavior often has the effect of disrupting normal family functioning as well as making the child unteachable in school. Because of these negative effects, many aggressive children are

taken out of the mainstream of society and placed in institutions. The absence of treatment in many of these institutions is a particularly serious shortcoming in the light of evidence showing that aggressive children often mature into aggressive adults (Robins, 1966).

Because of the above danger, researchers have focused much effort on trying to isolate the factors responsible for the maintenance of aggression in children. Thus, Patterson, Littman, and Bricker (1967) demonstrated that the aggressive behaviors of nursery school children generally received high levels of positive reinforcement from those children against whom the aggression was directed. The reinforcement typically took the form of the victim's giving up his toy or displaying various defensive postures. Reinforcement from adults has also been implicated as a factor in the maintenance of aggression in children, particularly when it takes

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the form of maternal attention delivered contingent on the emission of aggressive acts (Hawkins, Peterson, Schweid, & Bijou, 1966). Restructuring the environment so that aggressive behavior is no longer followed by the usual social reinforcers has proven to be a potent means of controlling this problem behavior (Brown & Elliott, 1965; Burchard & Tyler, 1965; Hamilton, Stephens, & Allen, 1967; Wolf, Risley, & Mees, 1964). Finally, vicarious positive reinforcement of aggressive acts has also been identified as an important factor in the maintenance of aggression, affecting the behavior in much the same way as direct reinforcement (Bandura, Ross, & Ross, 1963).

There are indications in the literature that aggressive behavior may be maintained by factors other than positive reinforcement. In particular, several investigators have implied that aggression may sometimes function as an escape response to terminate demands or other aversive stimuli (Ludwig, Marx, Hill, & Browning, 1969; Patterson, Littman, & Bricker, 1967). To date, however, there have been no systematic experimental studies of the possible role of escape factors in the maintenance of aggression. It would be useful to know what the effects of such factors might be, both from the standpoint of broadening our understanding of the variables maintaining aggressive behavior as well as from the standpoint of clinical treatment. In the present paper, we present a detailed, functional analysis of the behavior of two retarded children whose aggression appeared to be motivated primarily by escape factors.

## EXPERIMENT 1

In Experiment 1, we examined the effects of a simple demand situation on the aggressive behavior of two retarded children.

### *Method*

*Subjects.* Bob was a 14-yr-old who lived in a state institution. Sam was a 9-yr-old who lived at home and attended a private school. Each

boy had a diagnosis of mental retardation with autistic features. Both children were untestable on standard intelligence tests. However, Bob had a social age of 3.3 yr on the Vineland Social Maturity Scale and Sam scored 2.3 yr on the same scale. Both children were nonverbal and understood only simple commands. Neither initiated social interactions but would typically sit on the floor engaging in self-stimulatory behaviors, especially hand-gazing.

Bob's aggression began when he was 5 yr old and took the form of scratching, hitting, kicking, and biting. The behavior occurred with enough force to draw blood and produce bruises on his victims, who were almost always adults. Treatment of his aggression with drugs (Thorazine, Stelazine, Mellaril) was ineffective. Bob was referred to us by his teachers who complained that he became totally unmanageable when even a minimal demand, such as having to sit in a chair, was placed upon him.

Sam's aggression began when he was 6 yr old and consisted of pinching, hair pulling, and scratching, again directed almost exclusively at adults. Several treatments for his aggression, including drug intervention (Phenerganfortis), timeout, and the Feingold diet (Feingold, 1975), had been tried without success. Like Bob, Sam was referred by his teacher who reported that all attempts at instruction met with aggressive behavior.

*Setting and recording technique.* Sessions with Bob were conducted 5 days per week in a 3.0-by 2.5-m room on his ward. Two chairs were placed facing each other .4 m apart on one side of the room, one for Bob and one for the experimenter. The experimenter wore protective clothing, consisting of a thick corduroy coat and rubber gloves. On the opposite side of the room were a table and two chairs for the observers. The observers used prepared data sheets to tally the frequency of aggressive responses over 1-min intervals during each 5-min session. The following behaviors were defined as aggressive: scratching (digging in the fingernails and dragging them across the experimenter's skin or

clothing); hitting (striking the experimenter with the open or closed hand); kicking (striking the experimenter with the foot); and biting (closing the teeth on any part of the experimenter's body).

Sessions with Sam were conducted in a 2.2-by 1.5-m training cubicle under conditions identical to Bob's with the following exceptions: (a) the experimenter did not wear protective clothing because Sam's aggressive responses were not as damaging as Bob's; (b) sessions were 10 min long, rather than 5 min, because a longer period of aggressive behavior was more easily tolerated in working with Sam; and (c) the following behaviors were defined as aggressive: pinching (squeezing with a pincer grip), hair pulling (grasping or pulling the experimenter's hair), and scratching (defined as above).

The setting and recording technique described for this experiment was also used for subsequent experiments reported below.

*Procedure.* The effects of demands were studied using a reversal design whereby conditions in which demands were presented alternated with conditions in which demands were withheld. Additionally, during one of the demand conditions, we examined the effects of a stimulus which reliably signaled the termination of demands.

*Demands.* This condition reproduced the problem situation cited as most typical by each teacher. For Bob, the situation was being required to sit in a chair; for Sam, it was being instructed in a buttoning task.

Bob was brought into the room and told to "Sit down." The experimenter sat down in the chair in front of him and the session began. A "sit down" command was given each time that Bob attempted to leave (i.e., whenever he raised his buttocks 3 in. (7.5 cm) or more off the seat of the chair). If necessary, he was physically prompted to sit down again. Three additional commands accompanied by prompts occurred during the first session. No additional commands or prompts (after the start of a session) were necessary in the following sessions.

Thus, the demand consisted of the continuous requirement that he remain in the chair for the duration of the session once he was told to sit down. It must be emphasized that Bob had never been observed to sit in a chair (without being coerced) either in class or on the ward; he always sat on the floor in a corner of the room. Bob was to be praised at the end of each period in which he sat for 10 consecutive sec without aggression. However, because of continuous aggressive behavior, no praise was ever delivered. Although this made for a somewhat sterile treatment situation, it was, nonetheless, the same situation which prevailed daily in his classroom. Finally, the experimenter signaled the end of each session by removing his gloves, after which he led Bob from the room. This condition was in effect for Bob during sessions 1-3 and 8-17.

Sam was handed a buttoning board at the start of the session and once every 10 sec thereafter was instructed to button it. Physical prompts were provided, when necessary, in order to ensure that a correct response would occur on virtually every trial. Such prompts were given if the child failed to comply within 3 sec or if he complied but was unable to force the button through the hole within 3 sec of the onset of his response. Each correct response, whether prompted or unprompted, was reinforced with brief verbal praise because this was the customary practice in Sam's classroom and he typically responded by smiling. The experimenter signaled the end of each session by removing the buttoning board and placing it on a storage shelf, after which he returned Sam to his regular classroom. This condition was in effect for Sam during sessions 1-12, 19-24, and 36-43.

*No demands.* This condition was intended to approximate those periods of the day when Bob and Sam were not engaged in any structured activity. Bob was brought into the room but no demands were made of him. Invariably, he would sit on the floor in one corner of the room. The experimenter, who wore coat and gloves,

maintained a distance of .4 m from Bob, the same distance that would have existed had they both been seated. This condition was in effect for Bob during sessions 4-7 and 18-25.

In this condition, Sam was brought into the room and seated. The experimenter handed Sam the buttoning board but made no demands. He maintained a distance of .4 m from the child. This condition was in effect during sessions 13-18 and 25-35.

*Safety signal analysis.* During the first imposition of the Demands condition, it became evident that the stimuli used by the experimenter to end the sessions (i.e., removal of the gloves in the case of Bob and of the buttoning board in the case of Sam) had a profound effect on the rate of aggression of each child. To analyze this effect further, the following additional manipulations were made during the last Demands condition with each child. At the end of half of these sessions with Bob, the experimenter removed his gloves, as he normally did after 5 min, and no longer required Bob to sit in the chair. Because Bob invariably left his chair at this point to go to the corner, the experimenter followed Bob, maintaining a distance of .4 m. The observer continued to record aggressive acts for an additional (sixth) min, at the end of which the experimenter led Bob from the room. Sessions 8, 10, 11, 13, and 15 were concluded in the above manner and will be referred to as Safety Signal sessions (so named because the removal of the gloves signaled the onset of a "safety" period during which no more demands to remain seated were made). At the end of the other half of the sessions, the experimenter did not remove his gloves after 5 min and, again, no longer required Bob to sit in the chair. Bob invariably remained in his chair, however, during the minute which followed. At the end of the sixth min, the experimenter removed his gloves and led Bob from the room. Sessions 9, 12, 14, 16, and 17 were concluded in this manner and will be referred to as No Safety Signal sessions (so named because the gloves were not removed at the 5 min point).

At the end of half of the sessions of the last Demands condition with Sam, the experimenter removed the buttoning board, as he normally did after the 10 min had elapsed, and stopped making demands. The observer continued to record aggressive acts for an additional 5 min, after which the experimenter led Sam from the room. Sessions 36, 38, 39, and 40 were concluded in this manner and are therefore labeled (for the reason just given above) as Safety Signal sessions. At the end of the other half of the sessions, the experimenter stopped giving demands but did not remove the buttoning board. After the 15th min had elapsed, the experimenter removed the buttoning board and led Sam from the room. Sessions 37, 41, 42, and 43 were concluded in this way and are labeled as No Safety Signal sessions. It should be noted that Sam was intentionally exposed to the additional 5-min period at the end of the regular demand sessions, rather than the 1-min period used for Bob, in order to determine whether the effects observed for Bob could also be obtained with the longer time period. The procedure therefore constitutes an attempt at systematic replication (Sidman, 1960).

Reliability was assessed 11 times for Bob and 9 times for Sam, at least one assessment being made in each experimental condition. In this and all subsequent experiments, three reliability observers, each naive to the purpose of the experiment, were randomly assigned in pairs to record in various sessions. The response definitions were described verbally to each observer before the session began. During each session, the experimenter and two observers were present. For protection, the observers were seated behind a table .8 m wide, positioned a minimum of .9 m from the child. During the session, one observer signaled the end of each 1-min interval by tapping the leg of the other observer. Minute-by-minute monitoring was used for convenience because later analyses (e.g., Bob's performance in the Safety Signal condition) required frequency counts for each minute. The reliability index was the percentage of agreement between

the two observers, calculated separately for each session by dividing the smaller total frequency by the larger. The median interobserver reliability with Bob was 98% (range: 86% to 100%), and with Sam, it was 93% (range: 78% to 100%).

### Results and Discussion

The top half of Figure 1 shows the number of aggressive responses in each 5-min session for the two experimental conditions for Bob. The frequency of aggressive acts was high during the Demands condition and near zero during the No Demands condition. During the first

Demands condition, the mean frequency of aggressive acts was 121.7 per 5-min session. However, with the introduction of the No Demands condition in session 4, the rate abruptly fell to zero. When Demands were reinstated, the mean rate rose sharply to 128.3, falling again to .8 during the final No Demands condition.

The bottom half of Figure 1 shows the number of aggressive responses in each 10-min session for Sam. Once again, the frequency of aggressive acts was high during the Demands condition and at or near zero in the No Demands condition. During the first, second, and third Demands condition, the mean frequency of

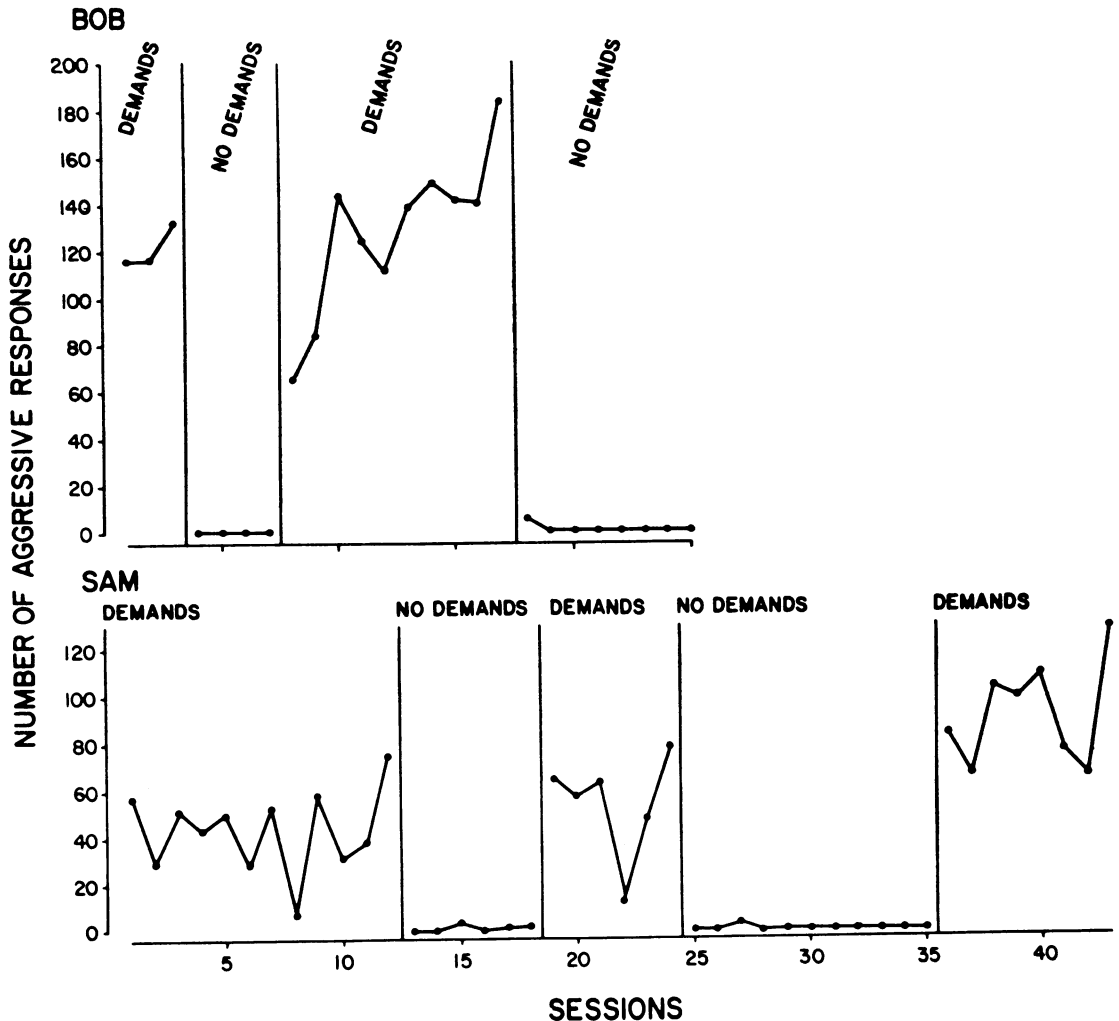


Fig. 1. Number of aggressive responses exhibited by Bob and Sam in each session of the Demands and No Demands conditions.

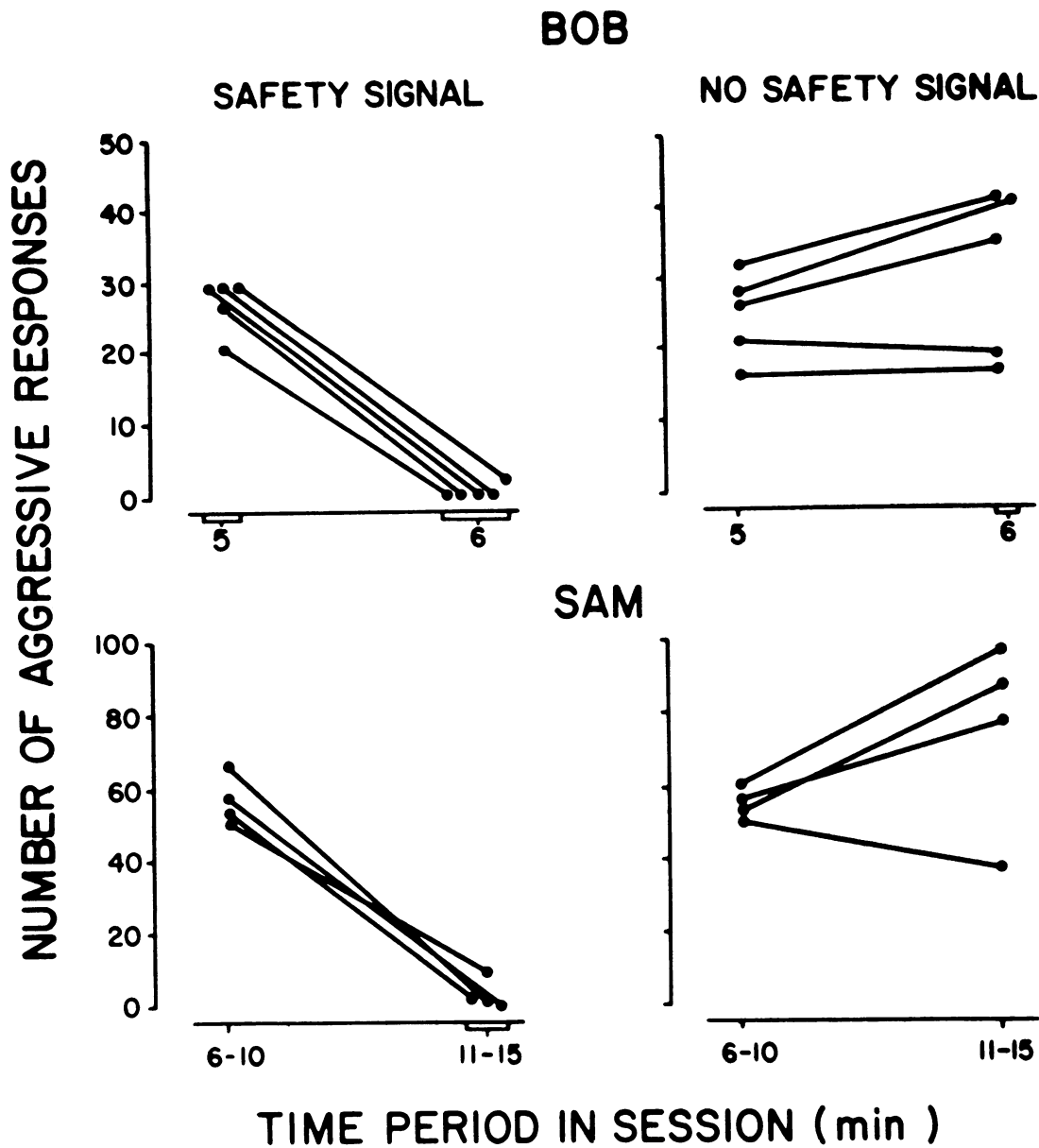


Fig. 2. Number of aggressive responses during the 5th and 6th min of each session in the second Demands condition for Bob (top half of figure) and during the 6th to 10th min and 11th to 15th min of each session in the third Demands condition for Sam (bottom half of figure). The left panels show data taken during Safety Signal sessions in which the experimenter signaled to each child that demands were no longer forthcoming. The signal was given to Bob at the start of the 6th min and to Sam at the start of the 11th min. The right panels show data taken during No Safety Signal sessions in which neither child received any cue that demands had ended. Some of the data points have been slightly displaced horizontally to enhance presentation clarity.

aggressive acts was 43.3, 53.7, and 91.1, respectively. During the first and second No Demands condition, the mean frequency of aggressive acts was 1.0 and .3, respectively.

The top half of Figure 2 shows the number of aggressive responses during the fifth and sixth min of each of the 10 sessions in the second Demands condition for Bob. The left panel

shows data taken during the five Safety Signal sessions and the right panel, data taken during the five No Safety Signal sessions. During the fifth min of the Safety Signal sessions, the mean number of aggressive acts was 26.6. However, during the sixth min, after the experimenter had signaled the termination of demands by removing his gloves, the mean number of aggressive acts fell to .4. In contrast, during the No Safety Signal sessions, the mean number of aggressive acts increased from a level of 24.6 during the fifth min to 30.6 during the sixth min.

The bottom half of Figure 2 shows the number of aggressive responses during the last 5 min of the regular session (i.e., the sixth to tenth min) and the 5-min period which followed the end of the regular session (i.e., the 11th to 15th min) for each of the 8 sessions in the third Demands condition for Sam. The left panel shows the data for the Safety Signal sessions, in which the number of aggressive acts fell from a mean of 56.5 during the last 5 min of the session to a mean of 3.0 during the 11th to 15th min, the time period which followed the experimenter's signal that demands had ended. During the No Safety Signal sessions (right panel), the number of aggressive acts increased from a mean of 55.8 during the last 5 min to a mean of 74.8 during the additional 5 min.

The high rate of aggression which occurred in the No Safety Signal condition was somewhat paradoxical since this condition was identical to the No Demands condition which produced almost no aggression. One explanation for this finding is that the absence of a safety signal during the No Safety Signal condition made it extremely difficult for the child to discriminate that the demands had indeed ended and therefore he responded as if the demands condition were still in effect, namely by continuing to exhibit aggressive behaviors. In contrast, in the No Demands condition, aggression was not set off in the first place since the child was never given any demands. In short, in the No Demands condition, the child was not presented with any stimulus that set off aggression, and

in the No Safety Signal condition the child was not presented with any stimulus that stopped aggression.

Experiment 1 demonstrated that a situation in which demands occur can be discriminative for high rates of aggressive behavior. Second, aggressive responding can be virtually eliminated when a stimulus that is correlated with the termination of demands is introduced. A plausible interpretation of the above results is that aggressive behavior can, under some circumstances, be conceptualized as an escape response. This interpretation draws its strongest support from the observation that Bob's rate of aggression dropped dramatically when the experimenter removed his gloves, and Sam's aggression abruptly decreased after the experimenter removed the buttoning board. These events were always used to signal the end of a session and were thus highly discriminative for the termination of demands. A stimulus which consistently signals the absence of an aversive event (such as demands might be) is technically referred to as a "safety signal" (Mowrer, 1960, p. 129). Typically, operant escape responding decreases in the presence of a safety signal (Azrin, Hake, Holz, & Hutchinson, 1965, p. 39). The fact that Bob and Sam stopped aggressing whenever the experimenter removed his gloves or the buttoning board suggests that these stimuli functioned as safety signals for them, indicating that the demands had ended and no further escape responses (aggressive acts) were necessary. In contrast, it is important to note that when the experimenter did not remove his gloves or the buttoning board (No Safety Signal sessions), thereby failing to signal that demands had terminated, Bob and Sam continued to aggress against the experimenter.

## EXPERIMENT 2

The results of Experiment 1 suggested that aggression may function as an escape-motivated response that serves to terminate an aversive demand situation. If this interpretation is valid,

then any treatment intervention aimed at making the demand situation less aversive should decrease the frequency of aggressive behavior. One plausible procedure for mitigating the aversiveness of the demand situation would be to introduce a variety of positive reinforcers known to be strongly preferred by the child. Accordingly, in the experiment that follows, we attempted to determine the effect of including such positive reinforcers in the demand sessions on the level of aggressive behavior exhibited in those sessions.

### *Method*

Sam alone participated because, as described below, a separate set of procedures was required to control Bob's aggression.

*Procedure.* The relationship between added positive reinforcement (in the form of toys and food) for correct responding, and the frequency of aggressive behavior was studied in a reversal design. ("Correct responding" refers to all correct responses, whether prompted or unprompted.) A condition in which brief verbal praise followed each correct response (the Demands condition) was alternated with a condition in which correct responses were followed by toy and food reinforcers in addition to praise (the Demands Plus Toys and Food condition).

*Demands.* This condition was identical to the Demands condition of Experiment 1 for Sam. It was in effect during sessions 1-5 and 13-15.

*Demands plus toys and food.* This condition was identical to the Demands condition, except that the experimenter now dispensed one of several toy or food reinforcers (in addition to the customary verbal praise) each time that Sam made a correct response. The reinforcers used were selected on the basis of a two-step process. In Step 1, the teacher was interviewed and a list of potential reinforcers was compiled based on her observations and recommendations. In Step 2, these reinforcers were arrayed on a desk and Sam was given free, continuous access to them. Reinforcers were chosen for inclusion in the present study if: (a) Sam reliably

consumed them or played with them each time that the reinforcer array was presented; and (b) Sam showed a consistent, marked preference for such reinforcers over others present in the array. The reinforcers chosen, based on the above procedure, were two music boxes, each of which played a simple tune, and two kinds of food items, specifically, potato chips and fruit ices. These reinforcers were distributed in a random order throughout each session with two constraints: the toy and food reinforcers were dispensed in equal proportions, and a given reinforcer was not presented more than three times in a row. When a toy reinforcer was delivered, the experimenter partially wound the music box and allowed Sam access to the music for 4 sec. Food reinforcement consisted of a single potato chip or half a teaspoon of fruit ice. This condition was in effect during sessions 6-12 and 16-25.

Reliability assessments were conducted during 7 sessions randomly distributed among the experimental conditions. The median interobserver reliability was 92% (range: 88% to 100%).

### *Results and Discussion*

Figure 3 shows the number of aggressive responses in each 10-min session for the two experimental conditions. The frequency of aggressive behavior was high during the Demands condition (just as it had been for the same condition in Experiment 1) and low in the Demands Plus Toys and Food condition. During the first Demands condition, the mean frequency of aggressive acts was 61.0. However, beginning with session 6, after the introduction of toys and food contingent on correct responding, the rate abruptly fell to a mean of 12.1. When Demands were reinstated, the mean rate rose sharply to 73.3, falling again to 9.8 during the final Demands Plus Toys and Food condition. An interesting, albeit anecdotal, observation was that the intensity of Sam's aggression during the Demands Plus Toys and Food condition was much less than it had been during the Demands



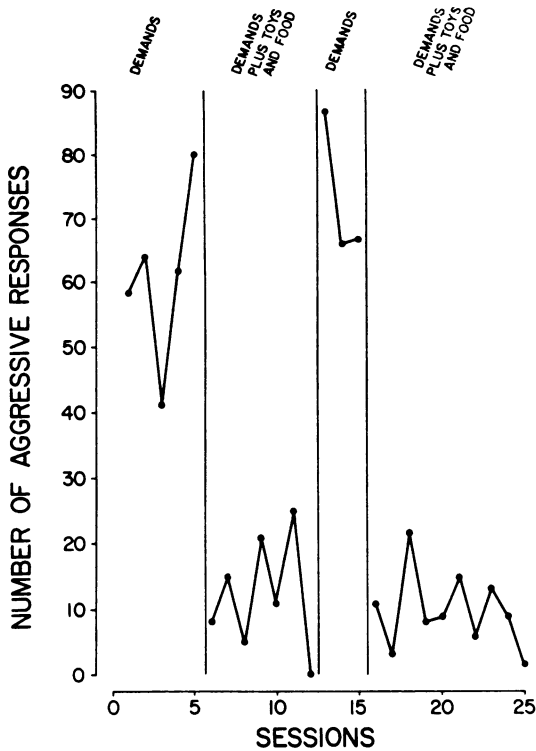


Fig. 3. Number of aggressive responses in each session of the Demands and Demands Plus Toys and Food conditions. Correct responses received only praise during Demands but received toys and food in addition to praise during Demands Plus Toys and Food.

condition and could easily be tolerated by the experimenter.

This experiment demonstrated that the addition of preferred positive reinforcers for correct responding greatly reduced the frequency of aggressive acts in the demand situation compared to what it had been when verbal praise alone was used as a reinforcer. As described above (Procedure section, Experiment 1), the method for presenting demands ensured that a correct response would occur on virtually every trial, and thus the number of correct responses in each session of both experimental conditions was essentially the same. Therefore, it is not the case that aggression declined in the Demands Plus Toys and Food condition because of an increase in the frequency of correct responses which interfered with the performance

of aggressive behavior. Secondly, the time required for the child to eat the food reinforcers or listen to the music was also not a factor in decreasing the aggression because the child's hands remained free during reinforcement, and aggressive behavior could easily have occurred at that time, and occasionally did. In short, the decrease in aggressive behavior during the Demands Plus Toys and Food condition was not the result of an increase in the frequency of a topographically incompatible response involving either buttoning or reinforcer consumption. Rather, one plausible interpretation of the decrease is that the addition of strongly preferred toy and food reinforcers reduced the aversiveness of the demand situation, thereby making the child much less likely to engage in escape-motivated behaviors such as aggression.

### EXPERIMENT 3

Our initial plan was to treat Bob's aggression using the same set of procedures described above for Sam. However, Bob, unlike Sam, showed no interest in any toys. Further, he would not consume more than a small quantity of any food reinforcer that was made available. In fact, next to aggression, Bob's main behavior problem centered on his refusal to eat at meal-times. Because of the above characteristics, a different treatment strategy, described below, was adopted.

To the extent that Bob's aggressive behavior was indeed an escape response, it follows that the behavior might have been strengthened, in the past, by negative reinforcement associated with the termination of demands. If this reasoning is correct, then it should be possible to reduce the level of aggression by changing the situation so that demands would be terminated only following the performance of a nonaggressive response. As the nonaggressive response was strengthened, that response should come to compete actively with the aggressive responses thereby reducing the frequency of the latter. Experiment 3 tested the above prediction.

### Method

**Procedure.** The effects of negative reinforcement on aggressive behavior and on an alternative nonaggressive response were studied using a reversal design. Within a given session, either aggression or the alternative nonaggressive response was negatively reinforced. Over sessions, the assignment of the negative reinforcement contingency was reversed across the two behaviors.

The two behaviors recorded were aggression, defined as in Experiment 1, and tapping, defined as a momentary contact of the index finger of one hand with the back of the other hand. Tapping was chosen as the alternative nonaggressive response because the behavior already existed at some strength, having been previously trained by a teacher as a gesture to indicate displeasure. In fact, during every demand session in which Bob participated, he emitted many tapping responses in addition to displaying aggressive behavior.

Each session consisted of three conditioning periods alternated with three test periods. Each conditioning period, in turn, consisted of five segments during which either aggression (sessions 1 and 3) or tapping (session 2, 4, 5, and 6) was followed by a 1-min period of escape from the chair (i.e., the experimenter no longer demanded that Bob remain seated). The conditioning period served to strengthen either aggression or tapping by a process of shaping. The purpose of the conditioning period was to simulate what went on every day in Bob's regular classroom. Typically, his teacher would tolerate greater and greater levels of aggressive behavior (or other problem behavior) before sending him to the corner. In this manner, it appeared that escape responding was being gradually (and inadvertently) shaped and strengthened. To attempt to reproduce this phenomenon experimentally, we carried out the following procedure. During the first segment of the first conditioning period of session 1, Bob was told to sit in the chair. When Bob had aggressed against the experimenter a

total of 5 times, the experimenter removed his gloves and allowed Bob to leave the chair to go to the corner. That is, Bob was negatively reinforced for aggressive behavior on a fixed-ratio schedule of 5 aggressive responses (FR5). When 1 min had elapsed, Bob was brought back and the second segment was run, in which he was allowed to escape on an FR10 schedule. The ratio requirement was increased in steps of 5 until the fifth segment, in which Bob was allowed to escape on an FR25 schedule. Following the fifth segment, the first test period was carried out. This consisted of a 1-min period during which no escape contingencies were in effect; that is, the experimenter required Bob to sit a full minute in his chair without being allowed to leave. The function of the test period was to determine what effect the recent history of negative reinforcement for aggression (or tapping) would have on the frequency of aggressive (or tapping) responses in a regular demand situation. Both tapping and aggression were recorded. Following the first test period, a second conditioning period was conducted during which the escape ratio was increased in steps of 5 from FR25 to FR45 after which another test period was run. Finally, a third conditioning period was conducted with the escape ratio increasing from FR45 to FR65, after which a final test period was run. In total, then, there were three conditioning periods which alternated with three test periods in each session (except during session 4 in which there were only two of each because of a ward emergency). The same procedures were applied when tapping was being negatively reinforced (sessions 2, 4, 5, and 6) except, of course, that tapping rather than aggression resulted in escape during the conditioning period. In summary, then, the independent variable was negative reinforcement for *either* aggressive behavior *or* tapping. Thus, in any given session, when one behavior was being negatively reinforced, the other functioned as a free operant with no constraints being placed upon it by the experimenter.

Reliability assessments were conducted dur-

ing each test period of sessions 3, 4, 5, and 6. The median interobserver reliability based on these 11 checks was 88% for aggressive acts (range: 79% to 100%) and 95% for tapping (range: 75% to 100%).

### *Results and Discussion*

Figure 4 shows the number of aggressive and tapping responses during each 1-min test period for the various experimental conditions. As can be seen, the frequency of aggressive acts declined rapidly following a series of conditioning periods in which tapping was strengthened through negative reinforcement (sessions 2, 4, 5, and 6). Consider session 2. Following FR25 escape training during the first conditioning period, Bob displayed 41 aggressive responses during the first test period. As the escape requirement was raised to FR45 and then FR65 during the second and third conditioning periods, Bob subsequently displayed 19 and then 10 aggressive acts during the second and third test periods, respectively. A second finding, which parallels the first, was that the frequency of aggressive acts increased over test periods following a series of conditioning periods in which higher and higher levels of aggression were required for escape (sessions 1 and 3). This finding reproduces the typical pattern observed in Bob's regular classroom, alluded to above. A third finding was that aggression and tapping were negatively correlated. The Pearson product-moment correlation coefficient was  $-.77$ ; that is, as the frequency of tapping increased, the frequency of aggression decreased, and vice versa.

Experiment 3 demonstrated that aggressive behavior can be decreased when an alternative, nonaggressive response is strengthened. Secondly, aggressive behavior can be increased if it is negatively reinforced through the termination of a demand situation. The data of Figure 4 support the hypothesis that negative reinforcement, in the form of escape from a demand situation, can be an important factor in the strengthening of aggressive behavior. Likewise, alternative, nonaggressive responses (such as

tapping) can also be strengthened by the same negative reinforcement factors, to the extent that such alternative responses may successfully compete with the aggressive behavior and reduce the frequency of aggression.

It is important to note that tapping and aggression were not physically incompatible responses. Tapping could and did occasionally occur together with kicking and biting. Further, there were periods of time during the test periods in which neither response occurred and therefore there was at least an opportunity for additional aggressive or tapping responses to occur. The two responses appeared to be antagonistic primarily in a functional sense; that is, both behaviors functioned as escape responses so that when one behavior was successful (i.e., negatively reinforced), the other became unnecessary and subsequently decreased in frequency.

## EXPERIMENT 4

In Experiment 3, it was clear that contingent escape from demands functioned as a negative reinforcer for aggression as well as for an alternative, nonaggressive response. Although the feasibility of substituting a nonaggressive response (tapping) for aggression was demonstrated, the problem of making Bob amenable to instruction remained because his continuous emission of escape responses (whether tapping or aggression) effectively removed him from the teaching situation. We therefore conducted a fourth experiment designed to eliminate aggression during teaching sessions as well as to initiate an imitation training program.

### *Method*

*Procedure.* The effects of extinction on aggression were studied in a reversal design in which an extinction condition was occasionally alternated with a negative reinforcement condition. After the effects of extinction were established, demands were gradually increased in frequency and complexity until they constituted an imitation training program.

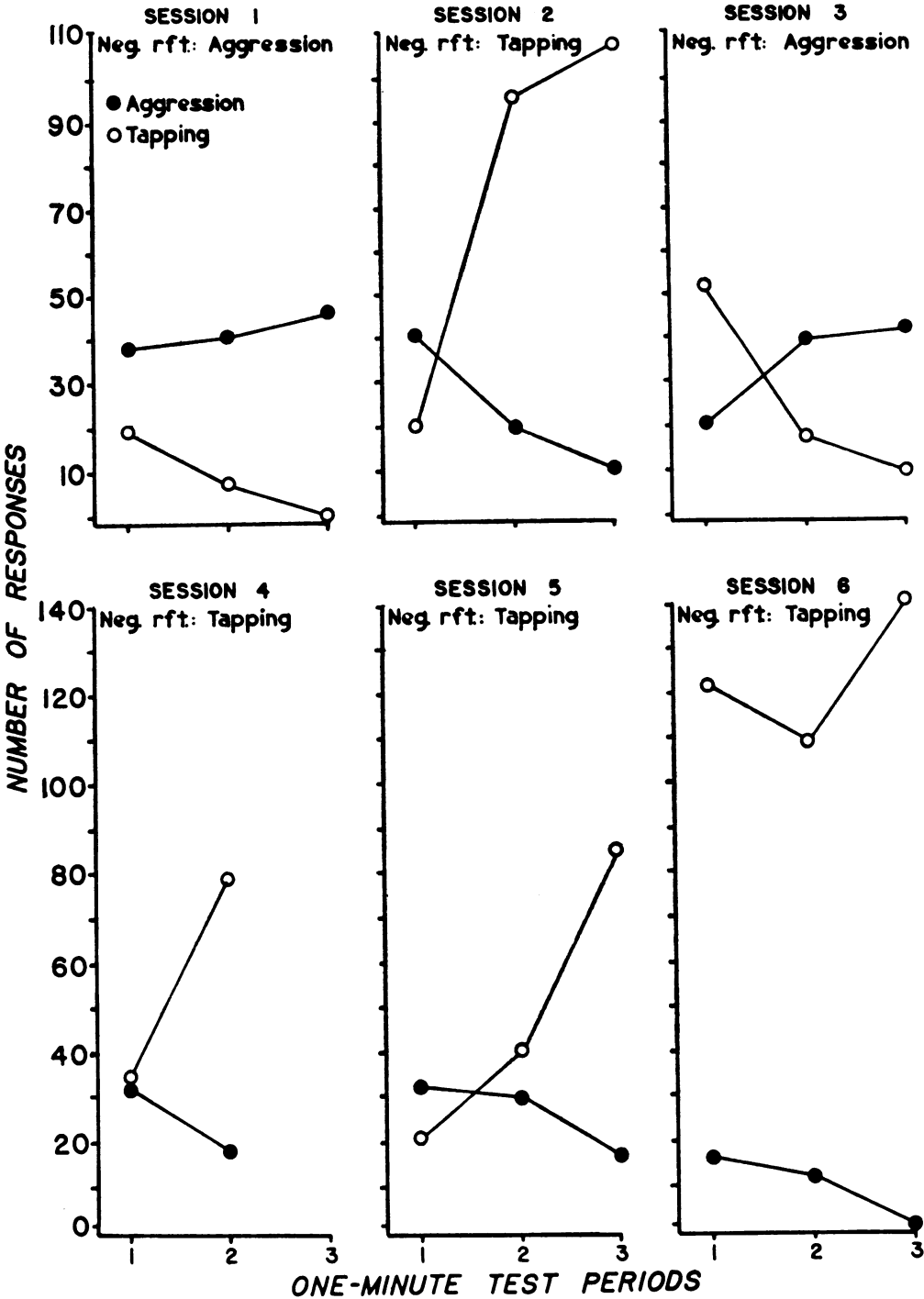


Fig. 4. Number of aggressive and tapping responses during each 1-min test period for the various experimental conditions. Just prior to each test period in sessions 1 and 3, the child was permitted to escape from a demand situation contingent on successively increasing levels of aggression; that is, aggression was strengthened by a process of negative reinforcement (Neg. rft.). The above procedure was repeated in sessions 2, 4, 5, and 6, with tapping as the response strengthened through negative reinforcement.

*Extinction.* The experimenter and Bob sat across from each other as in the Demands condition of Experiment 1, with the important exceptions that now each session lasted one hour and Bob was confined to his chair with a seatbelt across the thighs. This latter change was made because we assumed that the extinction of aggression would proceed most rapidly if the opportunity to escape was unambiguously eliminated. Bob was still free to use all of the aggressive responses in his repertoire. The experimenter, however, did not allow Bob to leave the chair irrespective of how intense or frequent his aggressive behavior. If any aggression occurred during the last 5 min of a session, the session was extended until at least 5 min had elapsed without aggression, in order to prevent aggressive behavior from being negatively reinforced by the termination of the session. (This became necessary only once, during session 2, which required an extra 37 min to complete.)

*Negative reinforcement of aggression.* These sessions (9, 13, and 18) were conducted as were those in the Extinction condition, except that aggressive responses were negatively reinforced with 1-min escape periods on an FR schedule. The FR requirement was one response at the start of each negative reinforcement session and then increased to FR5 and then increased again in steps of 5 after each escape period to a terminal value of FR25, where it remained for the rest of the session. As in Experiment 3, the experimenter counted aggressive responses, then unlatched Bob's seatbelt and allowed him to leave the chair for 1 min after each FR requirement had been met. The session terminated at the end of 1 hour whether or not aggression had occurred in the final 5 min. The 1-hour period refers to time spent in the session, exclusive of the 1-min escape periods.

*Gradual increase in demands.* Beginning with session 22, in order to further approximate more normal classroom conditions, a series of changes were introduced cumulatively into the Extinction condition. From session 22 onward, the

seatbelt was removed. The experimenter's protective coat was eliminated beginning in session 25, and his gloves were eliminated beginning in session 28. In session 32, nonverbal imitation training began at the rate of one trial (demand) every 5 min. The experimenter established eye contact with Bob, said "Do this," and modeled a hand clap. If Bob responded correctly, the experimenter praised him; if he responded incorrectly, the experimenter manually prompted a correct response and praised his cooperation. In each of the next four sessions, one additional imitation trial was added per 5-min block of time, on the average, so that by session 36, trials were being conducted at the rate of one per min. This rate of presenting trials was in effect for the remainder of the study. In session 37, a second imitative response, touching the head, was introduced. Thus, from session 36 to the end of the experiment at session 39, Bob was receiving discrimination training on two imitative responses, with an equal number of trials (30) of each type occurring randomly in each session.

Aggression data were collected as in Experiment 1. During imitation training sessions, the observer also recorded whether or not Bob's imitative responses were correct. There were a total of 11 reliability checks, at least one per condition. The median interobserver reliability for aggression was 97% (range: 85% to 100%), and for imitation, 100%.

### *Results and Discussion*

Figure 5 shows the number of aggressive responses per hour during each of the various experimental conditions. As can be seen from the figure, the extinction procedure did not initially produce a rapid decrease in aggression (in contrast to the procedure of strengthening an alternative, nonaggressive response, shown in Figure 4). Indeed, the number of aggressive responses remained at 500 or more for the first three sessions. However, by session 6 (after 5 hrs of extinction), the frequency of aggression

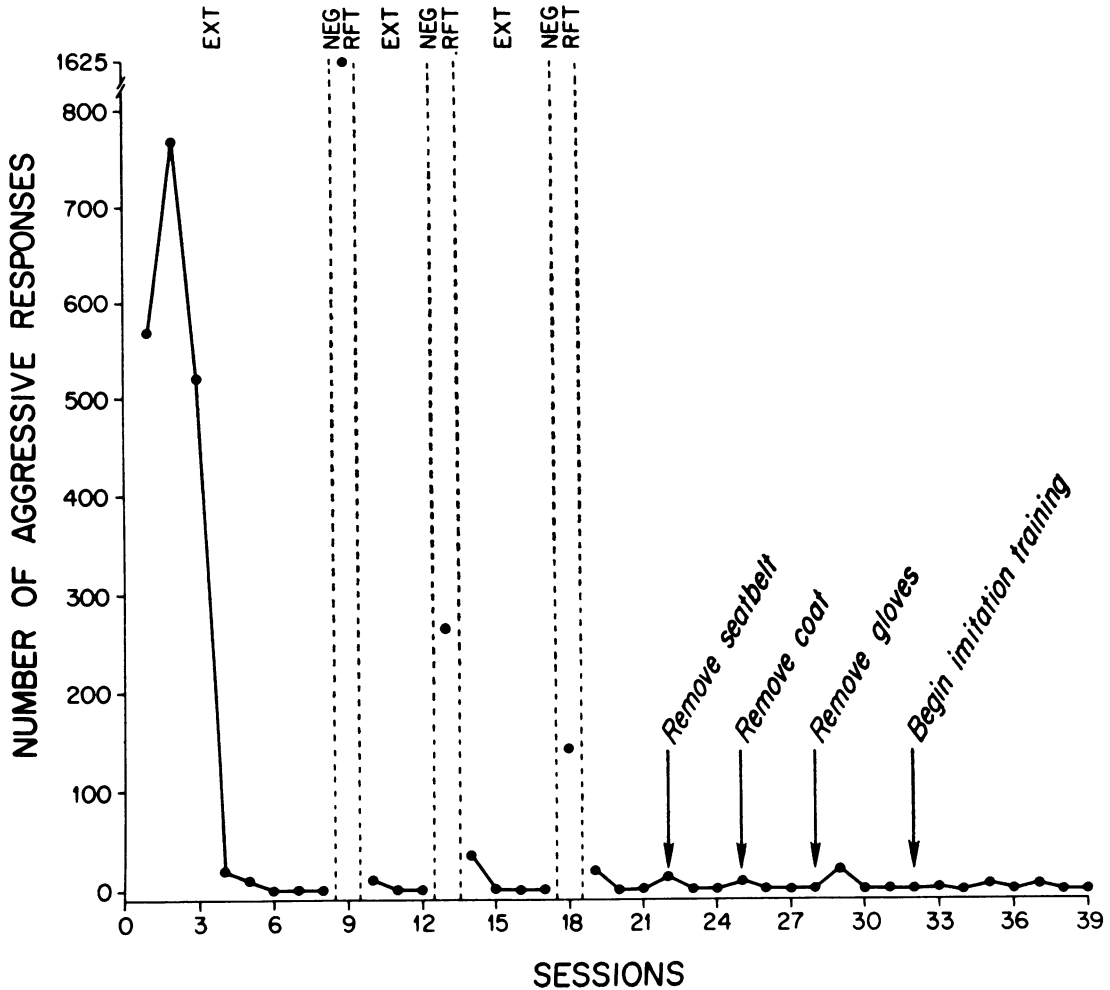


Fig. 5. Number of aggressive responses per hour during several experimental conditions. During extinction (EXT), the child was not permitted to leave the demand situation contingent on aggressive behavior. During negative reinforcement (NEG RFT), the child was allowed to leave the demand situation contingent on fixed numbers of aggressive responses. From sessions 22 to 39, EXT remained in effect while the experimenter faded out his protective clothing and faded in increasingly greater levels of imitative demands.

had dropped to 1 or 2 acts per session. With the introduction of negative reinforcement for aggression in session 9, the rate of aggression increased to 1,625 acts. It was possible to negatively reinforce aggression during selected sessions because Bob would almost invariably emit at least one aggressive response during the first 15 to 20 sec of each session.

When extinction was reintroduced during sessions 10-12, aggression abruptly fell to a near zero level. Each time that negative reinforcement was subsequently reintroduced (sessions 13

and 18), aggression abruptly increased, although there was a considerable diminution in the level of aggression with each successive introduction of negative reinforcement. This decrease might have been attributable to the cumulative effects of prolonged exposure to the aversive situation. Other research (e.g., Baum & Poser, 1971) has shown that such exposure can produce habituation to the aversive situation, thereby bringing about a gradual reduction in the frequency of maladaptive behaviors. Finally, each time that extinction was subsequently reintroduced

(sessions 14-16 and 19-39), aggression dropped abruptly to a near zero level.

During the last phase, when the protective clothing was removed and demands were increased, the rate of aggression remained near zero, although there was some tendency for aggression to increase slightly during the first or second session of each new condition (e.g., sessions 22 and 29). By the end of the experiment, Bob was correctly responding on a two-way imitative discrimination 97% of the time, with the imitative demands being presented at the rate of 1 per min for a full hour. All of this was occurring in the absence of any aggression (sessions 38 and 39).

Experiment 4 demonstrated that aggressive behavior could be virtually eliminated by the use of an extinction procedure. Because the demand situation was presumably aversive, the extinction procedure we used is more correctly labeled as "escape extinction" (Catania, 1968, p. 187), connoting the fact that it was the opportunity to terminate an aversive stimulus, which was eliminated. This procedure stands in contrast to more traditional extinction or timeout interventions which consist of the elimination of a positive reinforcer. The data of Experiment 4 suggest, in fact, that a timeout procedure, consisting of sending the child out of the session contingent on aggression, would serve only to strengthen escape-motivated aggression. In sum, the use of escape extinction in Experiment 4 not only eliminated aggressive behavior but also brought Bob to the point at which he could tolerate high frequencies of demands in a regular imitation training session.

## GENERAL DISCUSSION

Demands may constitute powerful discriminative stimuli for the emission of aggressive behavior while stimuli that signal the termination of demands may set the occasion for the cessation of aggressive behavior (Experiment 1). Thus, in some instances, aggressive behaviors serve an escape function. Indeed, when contin-

gencies were arranged so that the child was permitted to leave the demand situation after emitting fixed numbers of aggressive responses, the child displayed high levels of aggressive behavior, leading us to conclude that the termination of demands served as a negative reinforcer for the aggressive behavior (Experiments 3 and 4).

If aggressive behavior functions to allow a child to escape from aversive demand situations, then one treatment intervention could center on reducing the aversiveness of such situations. There are many plausible means for accomplishing this goal. One way, employed in Experiment 2, is to introduce into the demand situation a variety of toy and food reinforcers known to be preferred by the child. The specific reinforcers which one uses would, of course, vary from child to child. Irrespective of the reinforcer chosen, the principle is the same: preferred reinforcers are introduced into the demand situation in order to attenuate the aversiveness of that situation, thereby reducing the child's motivation to engage in escape behaviors, such as aggression.

For cases in which the above treatment strategy is not feasible, there are two other methods for dealing with escape-motivated aggression. The first is predicated on the assumption that there are instances in which it is appropriate for a child to display an escape response, provided that the response is socially acceptable. For example, consider the situation in which a nonverbal child has had enough to eat at dinner and appears ready to leave the table. Rather than dismissing the child after he or she has thrown a plate or punched another child, one could teach a socially acceptable escape response, such as a manual sign or gesture. The essence of the method just described is to strengthen alternative, nonaggressive escape responses with a negative reinforcement procedure. This tactic, successfully employed in Experiment 3, seems especially appropriate in situations in which escape does not interfere with the child's education. In educational settings, however, one has

no choice but to eliminate aggressive escape behaviors, since to allow the child to leave would not only strengthen the aggressive behaviors but would also terminate the opportunity to teach the child. The escape extinction procedure described in Experiment 4 thus represents a third method for treating escape-motivated aggression.

In addition to relating to the above treatment issues, the present results are noteworthy in that they add to a growing body of literature demonstrating that escape factors may play an important role in maintaining a broad spectrum of child psychopathology. Thus, negative reinforcement resulting from the successful escape from demands has also been implicated as a factor in the maintenance of self-injurious behavior (Carr, 1977; Carr, Newsom, & Binkoff, 1976), operant vomiting (Wolf, Birnbrauer, Williams, & Lawler, 1965), tantrums (Sailor, Guess, Rutherford, & Baer, 1968; Solnick, Rincover, & Peterson, 1977), hyperactivity (Ross & Ross, 1976, p. 80), disruptive classroom behavior (Plummer, Baer, & LeBlanc, 1977), and even asthmatic attacks (Creer, Weinberg, & Molk, 1974). Since high levels of demands are particularly apt to occur in school settings, the above literature should serve to alert teachers and clinicians to the possible escape function of problem behaviors observed in such settings. Given the current trend in our society toward providing educational opportunities for all handicapped children, it becomes especially important to understand the functional basis of demand-related escape behavior as well as to develop a technology for remediating the problem. Until these goals are met, many children will remain unteachable, and thus become candidates for institutionalization.

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